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Revision: Basic

Checkout Launch and Control System (CLCS)

Redstone Integration Report

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Checkout and Launch Control System (CLCS)

Redstone System Integration Report

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1.0 Introduction

This document will record the results of Checkout & Launch Control System (CLCS) system integration for the Redstone delivery. Results will be organized by CSCI and will cover the test configuration, procedures executed, and the results of the integration effort. Also included, is the hardware/configuration matrix of the Integration Development Environment (IDE-1) Appendix A, and a list of issues (problem reports) as a result of integration (Appendix B, Issue Reports).

Redstone integration was performed in the IDE-1 located in room 2R24 of the Launch Control Complex at Kennedy Space Center. System integration began on September 29, 1997 following the completion of the majority of CSCI Integration Testing and completed on October 7, 1997. CSCI Integration Testing began July 17, 1997, and completed on October 2, 1997.

2.0 Redstone Integration Results

2.1 System Services

2.1.1 Description

System Services consist of software required to provide communications in and between CLCS platforms. The software includes network services, local logging services, inter-process communications, system messages, initialization and termination services, display services, and the operating system (COTS). Software development was performed at Johnson Space Center (JSC) in Houston, Texas and at Kennedy Space Center (KSC) in Florida.

2.1.2 Test Execution and Results

The first step in the Formal System Integration process was to reload each platform in the IDE-1 with the latest Operating System baseline from the IDE-1 Boot Server. System Administration support was required during this step because root access permissions are required during the OS update process. There were several problems encountered following the OS update as evidenced by an incomplete configuration of the HCI's via Positional Login. It was found that path names in the log_win file were incorrect, ATM drivers were not loaded and essential subdirectories were not created during the OS update. These problems were procedural in nature and can be mitigated in the future with more complete OS update procedures.

Once these problems were corrected, System Control was utilized to download a SCID and TCID onto the HCI, DDP, and CCP platforms. System Control provided the method for checkout of Initialization & Termination Services. Messages recorded by

System Message Viewer were incomplete; however, the Xsession console window currently captures all system messages so this was considered a low priority issue. The positional DNAV menu was used to start platform applications & user displays with good results. Several minor issues were identified against the Master DNAV menu and are listed below.

Overall, System Services provided the underlying functions required to support inter-process communications and user interface to applications.

- Issues Generated:
  - I-221 Add Directories to OS Update File
  - I-223 Invalid Directory Paths in log_win Executable File
  - I-240 HCI not Licensed to Run SL-GMS After OS Download
  - I-244 Command Management not Running on HCI
  - I-253 System Message Viewer does not Display Messages Correctly
  - I-255 System Message Viewer does not Display Message Count Correctly
  - I-256 System Message Viewer Dies
  - I-254 Position File is Wrong for New Users
  - I-259 Mounts to /clcsdev are Intermittent
  - I-260 Some DNAV Options Should be Ghosted
  - I-261 DNAV Window Options do not Work Properly
  - I-262 DNAV - Log/Delog Crashes
  - I-263 DNAV - Delog to Printer does not Work
  - I-264 Reliable Multicast File Contains LCC-X Entries
  - I-265 PositionalMDF File References Nonexistent Directory
  - I-269 MasterMDF “Config Servers” Option Should be Ghosted
  - I-279 RM Timeout Values on the CCP to Gateway Streams
  - I-281 Platform routing tables not updating
  - I-297 Sticky Bit not set on /etc/init file
  - I-298 Missing LLS directory

2.2 System Control

2.2.1 Description

System Control provides the capability to configure/deconfigure DDP’s, CCP’s, Gateways, and HCI’s to support CLCS operations. This configuration includes downloading SCID and TCID software baselines and initializing the platform. This CSCI also supports the creation and management of activities within CLCS.

2.2.2 Test Execution and Results

An HCI in the IDE was dedicated as the Master Control workstation for purposes of creating activities, downloading baselines, and initializing platforms. The first problem encountered was the inability to create activities. This was due to the Activity Manager Permission file not including the CMA group as an authorized group for creating activities. Once this was corrected, an activity was created and downloaded to several platforms. A check of the processes initialized during login was done and revealed that the Data Distribution processes was not running. Downloading to a target platform previously downloaded with the Ground activity (activity 0) causes the Platform Parameter Table to not to be updated correctly.

Subsequent activity downloads revealed that multiple versions of the same process can be running on a platform at the same time. A workaround was implemented throughout System Integration and System Test to terminate the platform before downloading and initializing. After a successful download was completed, the SLWT displays were selected from the DNAV menu.

Although System Control did not become available until late in the integration process (i.e. after most of the CIT's were completed), it provided a much less labor intensive method of loading platforms with system baselines. This CSCI also provides a good method of identifying what activities (SCID/TCID) are loaded on each platform in the IDE-1 through the Master Control workstation.

- Issues Generated:
  - I-222 Activity Manager Permission File does not Include cma
  - I-228 Excessive Sleep in ocm_start_usrc
  - I-242 HCI Configuration Problems After Download of SCID/TCID
  - I-248 Multiple Processes Can be Started on DDP/CCP
  - I-249 Permissions on Executables in /clcs/uncert_apps are changed
  - I-250 OCM Remote Daemon Process Dies(omc_usrc_rmted)
  - I-251 Time Delay to Recognize Workstation from Master Control Panel after Reboot
  - I-270 Multiple Processes Still Running on HCI after Deconfigure
  - I-304 System Control Daemons not registering with NRS

2.3 Data Distribution

2.3.1 Description

Data Distribution includes the distribution, health status and fusion of Function Designators (FD). Data Distribution provides end-to-end flow of FD data from the RTCN to the DDP and then to HCI's and the CCP across the DCN. It provides for FD data retrieval by user applications and user displays. The software resident on the DDP provides the capability to read FD data from the gateways and distribute it to the RTCN and DCN. The software running on the CCP and HCI's provides the capability to receive FD data from the DDP and make it available to command, user applications, and user displays. Data Health software determines the integrity and validity (i.e. health) of each FD processed by the DDP and provides this status to the HCI's and the CCP. Data Fusion provides the capability to perform computations on FD's based on predefined algorithms.

2.3.2 Test Execution and Results

The Data Distribution functions were checked out through the display of STS86 playback data to the SLWT displays and FD viewer tools. Initialization of Data Distribution processes was verified through the use of System Control. Data verification was performed using PCGOAL displays. Some problems were noticed with the output of data on SLWT displays, these problems were already documented on issues: I-205, I-206, I-207. These issues deal with lack of initial data on displays, data not updating, and pseudo FDs not updating. All of these issues are currently in work and are planned to be fixed for the Redstone delivery. Data Fusion was not checked out during this period because the Data Fusion CIT was conducted after formal System Integration started.

- Issues Generated:
  - I-245 Data Health(ddh_control) does not run on DDP
  - I-306 DDP wyse terminal scrolling with messages.

2.4 Gateway Services

2.4.1 Description

Gateway Services provides the essential functions to make any CLCS gateways operational. This software is resident on the Gateway Control Processor and is initialized by the Real Time Operating System on the gateway local disk. It provides loading, activation, and termination functions for the gateway.

2.4.2 Test Execution and Results

The Consolidated Systems Gateway and GSE Gateway were the primary gateways used during System Integration & Test. The CSGW, which supported the test data generator software, provided the data path for STS84 and STS86 playback data. The primary integration effort involved coordination of stream names used by this GW during various phases of integration and testing. The GSE GW provided the data path for commands to and responses from the MPLM Refrigerator/Freezer. This gateway was initialized from the IDE-1 Boot Server utilizing GSE GW CIT startup procedures. The major problem encountered was the frequent lockup of the SCSI drive on the GSE GW. This problem required multiple reboots during startup and operation of the gateway. A software change was made to move the activation of the time card interrupt from boot time to activation time to solve this problem (issue I-209). There was no checkout of System Control download and initialization of the gateway platform because the CIT of this function was performed after formal integration began.

Overall, the Gateway Services software provided the services required to transmit commands and data from the End Items to the CLCS Control Group hardware. The majority of the problems noted were hardware related due to reuse of existing gateway components. These components will be replaced in future CLCS deliveries.

2.5 Command Support

2.5.1 Description

Command Support provides users and applications the ability to command end items in the Real Time Processing System. Commands are received by the HCI resident command management software which validates the authentication of the user and forwards the command onto the CCP. A CCP resident command management software performs authentication of the command and routes it to the appropriate gateway. The gateway command responses are sent back to the CCP command management and are then sent to the appropriate source.

2.5.2 Test Execution and Results

Command functions were attempted after all platforms were loaded using System Control. The download completed as expected but the Command Management process did not startup. Preliminary indications pointed to Timing Services as the source of the problem, but further investigation revealed that tunable shared memory parameters were not set properly during OS update. This resulted in Timing Services acquiring most of the available queues thereby preventing Command Management from initializing. After

the OS parameters were corrected, Command began to work but had loss of communication problems with the CCP and Gateway (lack of response).

Troubleshooting uncovered problems with the inter-process communication (IPC) software. IPC was creating a different transaction ID at each platform for the same transaction. This caused time out errors and unsolicited response system messages. Further investigation revealed: /etc/hosts file, containing "lccx" entries which in turn allows a greater number of authorized command platforms, causes problems with commanding (this is currently under investigation); platform routing table is incorrect (/etc/init.d/network.local was modified to correct "netmask bad" errors).

The Command development team provided excellent support during troubleshooting and workarounds were completed to provide reliable command capability in both the IDE-1 and LCC-X environments for demonstrations.

- Issues Generated:
  - I-268 Commanding from Multiple HCIs Fails
  - I-281 Platform routing tables not updating

2.6 System Viewers

2.6.1 Description

System Viewers provides a method of selecting additional detailed information about an FD. The various viewers provided are Status FD, Discrete Monitoring, Fusion, Health, Plot, FD Information, and Manual FD.

2.6.2 Test Execution and Results

The System Viewers were used throughout System Integration to display various FD information. The Plot Viewer functionality was tested and found to be unstable after several seconds of operation. The Plot Viewer was brought up manually from the command line and "crashed" shortly thereafter, creating a core file. An access method to the CVT was changed which solved this problem. The other viewer tools worked as expected.

The System Viewers provided good detailed FD information not available from other user displays. There were no other deficiencies found in this area.

- Issues Generated:
  - I-252 Plot Viewer does not Run
  - I-305 FD Viewer date does not match the cvt date.

2.7 Development Environment

2.7.1 Description

The Development Environment refers to the software used to manage all software production for CLCS. This includes the capability to define and build system software, to maintain a system build repository and to provide configuration management services for all software developed for CLCS.

2.7.2 Test Execution and Results

Testing of the development environment was first accomplished through CSCI Integration Testing. The integration effort involved utilizing the files created by the CM and system build processes. These files were initially ported from CM and manually loaded onto platforms in the IDE-1 to support CSCI Integration Testing, System Integration and System Testing. There was only one issue written which addressed the presence of a separate SCID for the COTS Data Fusion software (Control Shell). The separate build was made due to the large size of the compiled software (e.g. 86 meg). However, this situation prevents System Control from loading the DDP with an SCID. The download process was designed to load only one SCID per platform from the Boot Server. The workaround was to move the Data Fusion SCID to another directory and load it manually after the SCID is loaded. This is not a desirable solution and will need to be fixed in the future.

Overall, the Development Environment software consistently produced high quality system baselines for installation into the testing environments.

- Issues Generated:
    - I-266 DDP Baseline Consists of More Than One SCID(Fusion)

2.8 LCC-X

2.8.1 Description

The Launch Control Complex HCI Testbed (LCC-X) is a prototype environment for introducing users to the Operations Control Center of the future. State-of-the-art hardware and software are configured for demonstration of new technologies/methods of operation.

2.8.2 Test Execution and Results

There are no system level requirements for LCC-X. The integration effort involved setting up the software configuration and verifying data flow and display capabilities were available to support user demonstrations. A "live data" demonstration was conducted during the STS86 launch on 9/25/97. The LCC-X was left configured to support user console evaluations and future CLCS demonstrations using both live and playback data. The following results were obtained from LCC-X integration:

- Basic data flow capabilities were verified utilizing the Super Light Weight Tank monitoring displays
- Commanding of the MPLM Refrigerator/Freezer was performed by remote login to an HCI located in the IDE-1 due to host file conflicts.

3.0 Lessons Learned

I. Facility

A. Pagers are not reliable in IDE-1. A second phone line is needed in IDE-1.

B. Planning of hardware changes needs to be coordinated better. Hardware changes which affect the entire project should be planned for after hours and/or weekends, and should be tested more thoroughly before implementation.

C. The move of personnel needs to be coordinated much better. Network drops, phones (voice mail), and other facility requirements (electric, etc.) need to be in place and tested before moves take place. This will minimize the downtime required for move of personnel.

D. Room needs to be provided in IDE-1 for users to have desktop space. Space should be provided at each table for notebooks, manuals, etc.

II. Configuration

A. Controls are not in place to prevent unauthorized changes to SDE-1, SDE-2, and IDE-1.

1. Changes made to /etc/hosts files without testing ramifications
2. Installation of new OS modifications without sufficient testing
3. Firewall changes to IDE without notification

A panel has been created to handle modifications to any environment. No modifications are to be made to any environment without the approval of this panel. This panel is called the Integration Control Panel (ICP), and meets on Monday mornings at 10 am.

B. IDE-1 HWCI resources for Redstone was not sufficiently scoped during the delivery kick-off.

C. The OS configuration for Thor needs to be refined to provide a more operational-like environment. This process is currently in work. Changes to be made include:
   - disable of compilers/linkers in IDE and OCR
   - removal of demo programs in IDE and OCR
   - disable of CD-ROMs on HCI workstations

D. The SDE-1 and SDE-2 labs appear to need more resources. There are currently indigo workstations in the SDE labs that need to be replaced with o2 machines. This has been addressed. Indigo workstations have been replaced with o2 workstations.

E. Modifications to OS baselines and procedures are not under CM control
   - During formal system integration, it took 3 days to get the current OS baseline installed on all IDE-1 workstations

F. Multiple CCP's and DDP's should be planned for the future to support concurrent testing. There were many times when the DDP and CCP had to be reloaded with different baselines causing delays in testing and debug.

G. SDE-2 was not configured like the IDE-1. Dual ATM cards were not on boot server, CS GW does not function the same, DDP and CCP were Challenge machines.

H. The Houston environment and configuration was not maintained to the same configuration as KSC. When Houston developers brought the code developed in Houston it took several days to get it to run in SDE.

I. Communication between Houston and KSC was lacking in regard to environment variables and daemons that were available.

III. Processes

A. A formal release process needs to be defined for the project, and followed. This process would define weekly build schedules and installation and checkout of new SCID and TCID baselines.

The build schedule for Redstone was very hectic, with builds being performed 1-2 times daily during the CIT phase. Development personnel aggravated this by submitting software with compile and/or build errors. The lack of checkout time for new baselines before installation in IDE-1 also caused problems for the user community testing displays.

B. The process for promotion of baselines from development to CIT to System Test needs be refined and distributed. All CSCI leads need to be aware of the process they need to follow for promotion of baselines.

C. Coordination of formal issues will be performed by the Integration Control Panel. The process for bringing issues to the panel for approval needs to be defined and implemented. The process for bringing issues through the ICP is in work.

D. The CIT scheduling process needs to start much earlier in the development cycle. Steps have been taken to assist in this effort with the creation of a CIT Coordinator. This coordinator will have the responsibility of developing reasonable CIT schedules, and monitoring CIT development progress.

E. CIT test results need to be documented in a report, detailing pass/failure of test cases and issues written during the test. This report will aid System Integration, System Test, CIT Coordinator and Delivery Manager, as well as other CSCI leads.

APPENDIX A : IDE-1 REDSTONE HARDWARE/CONFIGURATION MATRIX

Description	Nasa #	Model #	Serial #	IP	OS Version	Baseline
ide1hci1				192.77.31.131		
Monitor	1866847	GDM-20E21	2059098			
O2	1866625	CMNB014ANT180	0800690CA93		Irix 6.3 970303	scid_system_test.redstone.1.1
ide1hci2				192.77.31.132		
Monitor	none	LA-2031JMW	CN606E37600063			
O2	1866610	CMNB014ANT180	0800690C917F		Irix 6.3 970303	scid_system_test.redstone.1.1
ide1hci3				192.77.31.133		
Monitor	1866842	GDM-20E21	2060635			
O2	1866606	CMNB014ANT180	0800690A8BA8		Irix 6.3 970303	scid_system_test.redstone.1.1
ide1hci4				192.77.31.134		
Monitor	1866841	GDM-20E21	2060574			
O2	1866836	CMNB014ANT180	0800690CA63C		Irix 6.3 970303	scid_system_test.redstone.1.1
ide1hci5				192.77.31.135		
Monitor	1865942	GDM-20E21	2017698			
O2	1866809	CMNB014ANT180	0800690CA392		Irix 6.3 970303	scid_system_test.redstone.1.1
ide1hci6				192.77.31.136		
Monitor	1504409	GDM-20E21	2034361			
O2	1867812	CMNB014ANT180	08006902BA33		Irix 6.3 970303	scid_system_test.redstone.1.1
ide1hci7				192.77.31.137		
Monitor	1866636	GDM-20E21	2060565			
O2	1867814	CMNB014ANT180	08006902B58C		Irix 6.3 970303	scid_system_test.redstone.1.1
ide1hci8				192.77.31.138		
Monitor	1867818	GDM-20E21	2054486			
O2	1867809	CMNB014ANT180	08006902BE12		Irix 6.3 970303	none
ide1hci9				192.77.31.39		
Monitor	1866826	GDM-20E21	2060639			
O2	1867815	CMNB014ANT180	08006902B564		Irix 6.3 970303	none
ide1hci10				192.77.31.30		
Monitor	1867817	GDM-20E21	2054483			
O2	1867810	CMNB014ANT180	08006902B591		Irix 6.3 970303	none
ide1ptr1	1866129	C3167A	USDH050044	192.77.31.183		
ide1boot				192.77.31.141	Irix 6.3 970303	
Monitor	1866846	GDM-20E21	2060640			
O2	1866829	CMNB014ANT180	0800690CA631			none
4mm tape drive	1613595	CTD8000E-S	DSK085R			
external hard drive (sgi 9Gb)	1867804	CMNB019B	189704931877			
external hard drive (sgi 9Gb)	1867805	CMNB019B	189704034653			
PC1 Expansion Chassis	1866211	21-700-2-2	123002			
ide1net				192.77.31.140		
Monitor	1866844	GDM-20E21	2060583			
O2	1866627	CMNB014ANT180	0800690CAE1A		Irix 6.3 970303	none
ide1ccp1				192.77.31.172		
Monitor (Wyse Tech)	1389064	WY-50	02Y13200769			
Origin 2000	1866563	CMN A015	K0006156		Irix 6.4	scid_system_test.redstone.1.1
Origin Vault	1866567					
ide1ddp1				192.77.31.170		
Monitor (Wyse Tech)	1392849	WY-185	0AK11400624			
Origin 2000	1866564		D2-H6404-1		Irix 6.4	scid_system_test.redstone.1.1
Origin Vault	1866518					
ide1nmg1 (gateway 2000)				192.77.31.188		
Monitor	1867517	CPD-6F250T	8028969			
CPU	1516335	BATC/P5-133	5700636		Irix 6.3 970303	
Access Firewall (Digital Alphaserver)						
Monitor	1387877	VRC21-KA	4K60709478			
CPU	1385274	PB50-AA	NI52900222			
Local Ron						
Monitor	1866374	CPD-GF200	7226266			
CPU	1515372	BATC/P5-133	5452005			
Local Network Mgmt Station						
Monitor	867528	JC1404HMA-1	09M82990			
CPU	1120862	none	910755			

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BIN1				163.206.63.102		
Monitor	1870187	Vivitron 1100	707045757			
CPU	1870136	LPMINI/P6-266	0007693340		Window NT 4.0	
BIN2				163.206.63.103		
Monitor	1870113	Vivitron 1100	706036261		Window NT 4.0	
CPU	1870159	LPMINI/P6-266	0007693357			
PC Goal Display Workstation						
Monitor	1372981	2082	5442512238			
CPU	1392775	none	1487			
Bridge						
Monitor	1121146	CM1440	15M2892B			
CPU	1126685	Tower-33	MB0704748			
STS86-Playback Computer				163.206.63.102		
Monitor	1870174	Vivitron 1100	706037191			
CPU	1870152	LPMINI/P6-266	0007693353			
STS84-Playback Computer				163.206.63.102		
Monitor	1035951	JC-1601VMA-2	25775561			
CPU	1040361		107912		DOS 6.22	
Portable Gateway				192.77.31.151		
	1868140	TVS-6U4816-226041141	9762		VxWorks 5.3	
CS Gateway 1				192.77.31.150		
	1391260	00083K01379	0012		VxWorks 5.2	
CS Gateway 2				192.77.31.149		
	1391261	00083K01379	0010		VxWorks 5.2	

Appendix B : Issue Reports

I-221 Add Directories to OS Update File
I-222 Activity Manager Permission File does not Include cma
I-223 Invalid Directory Paths in log_win Executable File
I-228 Excessive Sleep in ocm_start_usrc
I-240 HCI not Licensed to Run SL-GMS After OS Download
I-242 HCI Configuration Problems After Download of SCID/TCID
I-244 Command Management not Running on HCI
I-245 Data Health(ddh_control) does not Run on DDP
I-248 Multiple Processes Can be Started on DDP/CCP
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I-265 PositionalMDF File References Nonexistent Directory
I-266 DDP Baseline Consists of More Than One SCID(Fusion)
I-268 Commanding from Multiple HCIs Fails
I-269 MasterMDF “Config Servers” Option Should be Ghosted
I-270 Multiple Processes Still Running on HCI after Deconfigure
I-279 RM Timeout Values on the CCP to Gateway Streams
I-280 SDS GW Lock-up, tRootTask access fault
I-281 Platform routing tables not updating
I-296 Incorporate back-up process for IDE-1
I-297 Sticky Bit not set on /etc/init file
I-298 Missing LLS directory
I-304 System Control Daemons not registering with NRS
I-305 FD Viewer date does not match the cvt date.
I-306 DDP wyse terminal scrolling with messages.

Appendix C: Acronym List

ATM	Asynchronous Transfer Mode
CCP	Command and Control Processor
CIT	Computer Software Configuration Item Integration Test
CLCS	Checkout and Launch Control System
CM	Configuration Management
CMA	Configuration Management Administrator
CSC	Computer Software Component
CSCI	Computer Software Configuration Item
CSGW	Consolidated Systems Gateway
COTS	Commercial Off The Shelf
CVT	Current Value Table
DCN	Display and Control Network
DDP	Data Distribution Processor
DNAV	Display Navigation
FD	Function Designator
GSE	Ground Support Equipment
GW	Gateway
HCI	Human Computer Interface
IDE	Integrated Development Environment
IPC	Inter-Process Communications
JSC	Johnson Space Center
KSC	Kennedy Space Center
LCC-X	Launch Control Center Demo Facility (LCC “Bubble”)
MPLM	Mini Pressurized Logistics Module
OCR	Operations Control Room
OS	Operating System
RTCN	Real-Time Critical Network
SCID	Software Configuration Identification
SCSI	Small Computer System Interface
SDE	Satellite Development Environment
SL-GMS	Sherrill-Lubinski Graphical Modeling System
SLWT	Super Light Weight Tank
TCID	Test Configuration Identification